

XI. *An Account of some Experiments, made by Benjamin Robins Esq; F.R.S. Mr. Samuel Da Costa, and several other Gentlemen, in order to discover the Height to which Rockets may be made to ascend, and to what Distance their Light may be seen; by Mr. John Ellicott F.R.S.*

Read Dec. 13. 1750. **S**OON after the Exhibition of the Fire-works * in the Green Park, Mr. Robins communicated to this Society an Account of the Height to which several of the Rockets there fired were observed to rise. In this Account, after having given a short Description of the Instrument with which the Heights were measured, he observes, that the customary Height to which the single or honorary Rockets, as they are stiled, ascended, was about 465 Yards; that three of them rose to about 550 Yards; and the greatest Height of any of those fired in the grand *Girandole* was about 600 Yards. He likewise further observed, that, supposing Rockets are made to ascend 600 Yards, or more than a Third of a Mile, it follows, that if their Light be sufficiently strong, and the Air not hazy, they may be seen in a level Country at above 50 Miles Distance; and that, from the Nature of the Composition, and the usual imperfect Manner of forming them, he was of Opinion that Rockets were capable of being greatly improved, and made to reach much greater Distances.

Mr.

* On Occasion of the late Peace.

Mr. *Robins* not having been able to obtain any certain Account to what Distance any of these Rockets were actually seen, and considering the great Use that might be made of Rockets in determining the Position of distant Places, and in giving Signals for naval and military Purposes, he resolved to order some Rockets to be fired at an appointed Time, and to desire some of his Friends to look out for them at several very distant Places.

The Places fix'd upon for this Purpose, were, *Godmarsham* in *Kent*, about 50 Miles distant from *London*; *Beacon Hill* on *Tiptery-Heath* in *Essex*, at about 40 Miles; and *Barkway*, on the Borders of *Hertfordshire*, about 38 Miles from *London*.

Mr. *Robins* accordingly order'd some Rockets to be made by a Person many Years employ'd in the Royal Laboratory at *Woolwich*; to which some Gentlemen, who had been inform'd of Mr. *Robins*'s Intentions, added some others of their own making. The 27th of *September*, 1749. at 8 in the Evening, was the Time appointed for the firing of them; but, thro' the Negligence of the Engineer, they were not let off till above half an Hour after the Time agreed upon. There were in all a dozen Rockets fired from *London Field* at *Hackney*; and the Heights were measur'd by Mr. *Canton*, Mr. *Robins* being present, at the Distance of about 1200 Yards from the Post from whence the Rockets were fir'd. The greatest Part of them did not rise to above 400 Yards; one to about 500, and one to 600 Yards nearly.

By a Letter I receiv'd the next Day from the Rev. Dr. *Mason*, of *Trinity College, Cambridge*,
E e c e who

who had undertaken to look out for them from *Barkway* on the Borders of *Hertfordshire*, I was informed, that, having waited upon a Hill near the Town with some of his Friends till about haif an Hour past the Time appointed, without perceiving any Rockets, as they were returning to the Town, some of the Company seeing thro' the Trees what they took to be a Rocket, they immedately hasten'd back out of the Closes into the open Fields, and plainly saw 4 rise, turn, and spread: He judged they rose about one Degree above the Horizon, and that their Lights were strong enough to have been seen much farther.

From *Essex* I was inform'd, that the Persons on *Tiptery-Heath* saw 8 or 9 Rockets very distinctly, at about half an Hour past 8; and likewise greatly to the Eastward of these 5 or 6 more. The Gentlemen from *Godmarsham* in *Kent* having waited till above half an Hour past 8, without being able to discern any Rockets, they fired half a dozen; which, from the Bearings of the Places were most probably those seen to the Eastward by the Persons upon *Tiptery Heath*; and if the Situations, as laid down in the common Maps, are to be depended upon, at about 35 Miles Distance.

The Engineer being of Opinion that he could make some Rockets, of the same Size as the former, that should rise much higher, Mr. *Robins* order'd him to make half a dozen. These last were fired the 12th of *October* following, from the same Place, and in general they rose nearly to the same Heights with the foregoing; excepting one which was observed to rise 690 Yards. The Evening prov'd very hazy,

hazy, which render'd it impossible for them to be seen to any considerable Distance.

It being observ'd in these Trials, that the largest of the Rockets, which were about 2 Inches and a half in Diameter, rose the highest, Mr. *Robins* intended to have made some more Experiments, in order to a farther Discovery what siz'd Rockets would rise highest: But his Engagements with the *East India Company* preventing him, Mr. *Samuel Da Costa* late of *Devonshire-Square*, a Gentleman of an extraordinary Genius in Mechanics, and indefatigable in the Application, Mr. *Banks*, a Gentleman who had for many Years practis'd making Rockets, and two other Persons, undertook the prosecuting these Enquiries; and having made several Experiments as well with regard to the Composition, as the Length which Rockets might be made to bear, in proportion to their Diameters, and of different siz'd Rockets, from 1 Inch and a half to 4 Inches Diameter, they intended this Winter to have made Trial of some of a yet greater Diameter, had not the Death of Mr. *Da Costa* prevented it.

I shall therefore beg Leave to give some Account of the Success which has hitherto attended their Undertaking, so far as they went: And as it has been much beyond what was expected, I am in hopes this short Relation will not prove unacceptable.

Amongst some Rockets fired in the last Spring, there were two made by Mr. *DaCosta* of about 3 Inches and a half Diameter, which were observed to rise, the one to about 833, the other to 915 Yards. At a second Trial, made some time after,

there was one made by Mr. *Da Costa*, of 4 Inches Diameter, which rose to 1190 Yards. The last Trial was made the latter End of *April 1750*, where 28 Rockets were fired in all, made by different Persons, and of different Sizes, from 1 Inch and a half Diameter to 4 Inches; the most remarkable of each Size were as follows; one of 1 Inch and a half rose to 743 Yards; one of 2 Inches to 659; one of 2 Inches and a half to 880; another of the same Size, which rose to 1071; one of 3 Inches to 1254; one of 3 Inches and a half to 1109; and one of 4 Inches; which, after having rose to near 700 Yards, turned, and fell very near the Ground before it went out. These were all made by Mr. *Da Costa*. Besides these, there was one of the Rockets of $2\frac{1}{2}$ Inches in Diameter, which rose to 784 Yards, and another made by Mr. *Banks* of the same Size to 833.

As the making of large Rockets is not only very expensive, but likewise more uncertain than those of a lesser Size, so from the last Experiments it is evident, that Rockets from 2 Inches and a half to $3\frac{1}{2}$ Inches Diameter, are sufficient to answer all the Purposes they are intended for; and I doubt not may be made to rise to an Height, and to afford a Light capable of being seen to considerably greater Distances than those before-mention'd.

Before I conclude this Account, it may not be improper to take notice, that, tho' the Heights of the Rockets are set down to a single Yard, it is not pretended the Method made use of (tho' sufficient for all the Purposes of these Experiments) is capable of determining the Heights to so great an Exactness:

actness; for, as they were measur'd by only one Observer, it is evident, that, if any of the Rockets deviated from the Perpendicular, so as either to incline towards the Place of Observation, or to decline from it, the Height would be given either greater or less than the Truth; but as the Base upon which they were measur'd was 1190 Yards, the greatest Error that can arise on this Account will be but very inconsiderable. If we should suppose there might be an Error of 30 or even 50 Yards, which is very highly improbable, it must then be allowed, that several of these Rockets rose to 1000 Yards, one to 1100, and another to 1200 Yards, or double to any of those fired in the *Green Park*.

I have been informed, that the Relation of this Affair has appeared so very extraordinary to some Gentlemen conversant in such Matters, that they have mention'd it as their Opinion, that there must certainly have been some Mistake, either in placing the Instrument, taking the Heights, or otherwise. In answer to which I would observe, that, in all the Experiments mentioned in this Paper, the Heights were all taken by the same Person, *viz.* Mr. *John Canton*, and that the last Trial was made in the Presence of several very worthy Members of this *Society*. That the Instrument, being first fixed to a proper Angle was not alter'd during the whole Time of Trial; and therefore, if there had been any Mistake in fixing it, that Mistake would have varied the Height of all the Rockets as much as those of Mr. *Da Costa's*; but it was those of Mr. *Da Costa's* only, and that at three different Trials, which rose to such extraordinary Heights; and

and therefore I think we have sufficient Reason to conclude that their Measures were certainly taken very near the Truth.

John Ellicott.

XII. *Several Papers concerning a new Semi-Metal, called Platina; communicated to the Royal Society by Mr. Wm. Watson F. R. S.*

I.

Extract of a Letter from William Brownrigg M. D. F. R. S. to Wm. Watson F. R. S.

Dear Sir, Whitehaven, Dec. 5, 1750.

Read Dec. 13. 1750. I TAKE the Freedom to inclose to you an Account of a Semi-metal call'd *Platina di Pinto*; which, so far as I know, hath not been taken notice of by any Writer on Minerals. Mr. *Hill*, who is one of the most modern, makes no mention of it. Presuming therefore that the Subject is new, I request the Favour of you to lay this Account before the *Royal Society*, to be by them read and published, if they think it deserving those Honours. I should sooner have published this Account, but waited, in hopes of finding Leisure to make further Experiments on this Body with sulphureous and other Cements; also with Mercury, and several corrosive *Menstrua*. But these Experiments I shall now defer, until I learn how the above is receiv'd. The Experiments which I have related were several of them made by a Friend, whose Ex-